declination. The results which he has obtained are utterly irreconcilable with the theory of Bernoulli, and therefore the tables computed upon that theory must be rejected as inaccurate.

A paper was also read, entitled, "On the Nature of Sleep." By A. P. W. Philip, M.D. F.R.S. L. & E.

The author intends the present paper as a continuation of his inquiries into the relations subsisting between the nervous and muscular systems, which form the subject of his former papers, but which would be incomplete without the consideration of their condition during sleep. With this view he proposes to determine the particular organs, on the condition of which this peculiar state of the system depends; the laws by which it is governed; and the influence it has upon other parts of the system. The necessity of intervals of repose applies only to those functions which are the medium of intercourse with the external world, and which are not directly concerned in the maintenance of life. The organs subservient to these two classes of functions may be viewed as in a great degree distinct from one another. The brain and spinal marrow constitute alone the active portions of the nervous system. The law of excitement, which regulates the parts connected with the sensorial functions, including sensation, volition, and other intellectual operations, and the actions of the voluntary muscles, is uniform excitement, followed by a proportional exhaustion; which, when occurring in such a degree as to suspend their usual functions, constitutes sleep; all degrees of exhaustion which do not extend beyond the parts connected with the sensorial functions being consistent with health. On the other hand, the law of excitement of those parts of the brain and spinal marrow which are associated with the vital nerves, and are subservient to the vital functions, is also uniform excitement; but it is only when this excitement is excessive that it is followed by any exhaustion; and no degree of this exhaustion is consistent with health. The law of excitement of the muscular fibre, with which both the vital and sensitive parts of the brain and spinal marrow are associated, namely, the muscles of respiration, is interrupted excitement, which, like the excitement of the vital parts of these organs, is, only when excessive, followed by any degree of exhaustion. The author conceives that the nature of the muscular fibre is everywhere the same; the apparent differences in the nature of the muscles of voluntary and involuntary motion depending on the differences of their functions, and on the circumstances in which they are placed: and he concludes, that, during sleep, the vital, partaking in no degree of the exhaustion of the sensitive system, appears to do so simply in consequence of the influence of the latter on the function of respiration, the only vital function in which these systems co-operate.

The author proceeds to make some observations on the cause of dreaming, the phenomena of which he conceives to be a natural consequence of the preceding proposition. In ordinary sleep, the sensitive parts of the brain, with which the powers of the mind are associated, are not in a state of such complete exhaustion as to preclude their being excited by slight causes of irritation, such as those which

accompany the internal processes going on in the system. The sensorium is the more sensible to the impressions made by these internal causes, inasmuch as all the avenues to external impressions are closed, and the mind is deprived of the control it exercises, during its waking hours, over the train of its thoughts, by the help of the perceptions derived from the senses, and the employment of words for detaining its ideas, and rendering them objects of steady attention, and subjects of comparison.

March 14, 1833.

The Rev. WILLIAM BUCKLAND, D.D., Vice-President, in the Chair.

A paper was read, entitled, "On the Figures obtained by strewing Sand on Vibrating Surfaces, commonly called Acoustic Figures." By Charles Wheatstone, Esq. Communicated by Michael Faraday, Esq. D.C.L. F.R.S.

The author, after adverting to the imperfect notice taken by Galileo and by Hooke of the phenomena which form the subject of this paper, ascribes to Chladni exclusively the merit of the discovery of the symmetrical figures exhibited by plates of regular form when made to sound. He proposes a notation, by means of two numbers separated by a vertical line, for expressing the figures resulting from the vibrations of square or rectangular plates. He gives a table of the relative sounds expressed both by their musical names and by the number of their vibrations, of all the modes of vibration of a square plate, as ascertained by the experiments of Chladni. He then proceeds to class and analyse the various phenomena observed under these circumstances, and shows that all the figures of these vibrating surfaces are the resultants of very simple modes of oscillation, occurring isochronously, and superposed upon one another; the resultant figure varying with the component modes of the vibration, the number of the superpositions, and the angles at which they are superposed. In the present paper, which forms the first part of his investigation, he confines himself to the figures of square and other rectangular plates.

The author finds that the principal results of the superposition of two similar modes of vibration are the following:—first, the points where the quiescent lines of each figure intersect each other remain quiescent points in the resultant figure; secondly, the quiescent lines of one figure are obliterated, when superposed, by the vibratory parts of the other; thirdly, new quiescent parts, which may be called points of compensation, are formed whenever the vibrations in opposite directions neutralize each other; and, lastly, at other points, the motion is as the sum of the concurring, or the differences of the opposing vibrations at these points. After considering various modes of binary superposition, the author examines the cases of four co-existing superpositions.

When the vibrations of the superposed modes are unequal in intensity, there is formed a figure intermediate between the perfect re-